Measurement of project success

Anton de Wit

The question of whether success can be measured and the purpose of it is discussed. In any discussion on success, it is essential that a distinction is made between project success and the success of the project management effort, bearing in mind that good project management can contribute towards project success but is unlikely to be able to prevent failure. The most appropriate criteria for success are the project objectives. The degree to which these objectives have been met determines the success or failure of a project. The criteria for success of the project management effort tends to be restricted to cost, time and quality/performance. When measuring project success, one must consider the objectives of all stakeholders throughout the project life cycle and at all levels in the management hierarchy. Therefore, to believe that, with such a multitude of objectives, one can objectively measure the success of a project is somewhat an illusion.

Keywords: project management, success, project objectives, performance

Measuring success – can it really be done, and if carried out, what purpose does it serve?

The PMI conference held in Montreal in 1986, for which an earlier version of this paper was prepared, was devoted to 'measuring success'. The conference aim was to focus on how important good measurement of progress, cost and quality is to the success of a project.

This implies that it is possible to determine the success of a project in the first place.

The measurement of progress, cost and quality is no doubt an essential part of project control but this activity should certainly not be confused with measuring success. When attempting to measure success one must make a distinction between project success and the success of the project management effort, as the two although related, may be very different.

Factors affecting project success or failure are often cited in the project literature but are they really of any use for measuring success? Certainly, these factors are usually good indicators of pre-conditions of success or failure. They could be said to be analogous to Hertzberg's hygiene factors of motivation in that the presence of success factors does not guarantee success but their absence is likely to lead to failure.

The most appropriate criteria for success are the project objectives. The degree to which these objectives have been met determine the success of the project. This all seems simple. However, problems arise when one tries to list the objectives of a project and one then discovers that there are quite a few more objectives involved in a project than just simply cost, time and quality. This is particularly true when one considers all stakeholders in a project. The objectives also tend to change for each major phase in the project life cycle. Additionally, there is a hierarchical dimension to success as the primary objectives also vary for each level of management in an organization.

The multitude of objectives throughout the project life cycle, the hierarchical relationship and the often conflicting criteria of the stakeholders can be illustrated by a 'project success framework' which will be discussed later.

Finally, the difference between the measurement of performance and success is discussed, including a review of some methods from the project management literature. With the use of the project success framework, these methods are then put in perspective with regards to which and whose objectives have been considered.

PROJECT AND PROJECT MANAGEMENT SUCCESS

Why should we make a distinction between project and project management success? If one defines success in

Deminex (Norge) A/S, Wergelandsveien 7, PO Box 1767 Vika, N-0122 Oslo 1, Norway

 0263–7863/88/030164–07 $03.00

terms of the achievement of objectives, then the answer depends on whether the objectives for the project and for the project management activity are the same or not.

Most project management literature advocates that project management has three major objectives: a project must be managed on time, within budget and to quality/performance specifications. By doing so, the project will be successful but is it really that simple?

We all know examples of projects which have not been completed on time and within budget and are nevertheless considered to be successful projects.

Research conducted in the USA on some 650 completed projects[1] confirmed the irrelevance of time and cost to the perceived success of a project.

It was found that cost and schedule overrun were not included in a list of twenty-nine project management characteristics significant to perceived project failure. Conversely, good cost and schedule performance were not included in a list of twenty-three project management characteristics significantly related to perceived success, nor were cost and schedule performance included in the list of ten project management characteristics found to be linearly related to both perceived success and perceived failure. The following definition of project success was derived from this research: the project is considered an overall success if the project meets the technical performance specification and/or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among key people in the parent organization, key people in the project team and key users or clientele of the project effort.

These findings may be somewhat difficult to accept by most project personnel but it certainly explains why, for example, North Sea projects in the 1970s which suffered from substantial cost and time overruns were considered to be successful. The enormous increases in the price of oil in 1973 and 1979 prevented disaster and made them very profitable. In fact, many large projects are saved from disaster by fortuitous circumstances[2].

One frequently observes that a project team gets credit for a successful project which it does not deserve and conversely, the team may be incorrectly blamed for a project failure.

A project can be a success despite poor project management performance and vice versa. The conclusion one may draw from the above is that for measuring success, a distinction should be made between the success of the project and the success of the project management activity. The two are often mixed up. Good project management can contribute towards project success but is unlikely to be able to prevent project failure.

FACTORS AFFECTING PROJECT SUCCESS

Various authors have identified a number of factors, either from experience or research that are important to project success. Hayfield[3], for example, identified two sets of factors that determine the successful outcome of a project. A set of macro factors falling mostly in the realm of the owner and a set of micro factors which are more in the engineer/constructor's domain.

Macro factors

- Realistic and thorough definition of project – What
- Efficient manner of project execution – How
- Comprehension of project 'environment' – Context
- Selection of organization realizing project – By whom

Micro factors

- Formulation of sound project policies – Policies
- Clear and simple project organization – Framework
- Selection of key personnel – Human resources
- Efficient and dynamic management controls – Controls
- Reliable management information systems – Information

These factors are based on the definition of a successful project by the author as being one that is completed on time, within budget and to performance specification. This definition implies that only the engineering and construction portion of the total project life cycle is being considered.

At the University of Texas, a pilot study was carried out on construction project success and its repeatability[4]. It included successful projects only. The results from this pilot study showed that the likelihood of achieving a successful construction project is greatly enhanced by placing more emphasis on the following success factors:

- planning efffort (construction)
- planning effort (design)
- project manager goal commitment
- project team motivation
- project manager technical capabilities
- scope and work definition
- control systems

The results also showed that there are six success criteria most frequently used to measure construction project success:

- budget performance
- schedule performance
- client satisfaction
- functionality
- contractor satisfaction
- project manager/team satisfaction

A regression analysis showed that certain factors are more directly related to individual success criteria and their achievement than others. The ones with the strongest relationship were:

Success factor	Success criteria
Planning effort (construction)	Functionality
Project manager technical capabilities	Client satisfaction
Technical uncertainty	Client satisfaction
Project manager administration capabilities	Budget performance
Legal political environment	Follow-on work

The results of the pilot study are such that the researchers are optimistic that they will be able to give owners, designers and contractors valuable insights into how they can consistently achieve superior results on their projects[5].

Judging by the success criteria in this study, it would seem that the stakeholders considered are the client, contractor and the project team. In addition, research seems also to be limited to the engineering and construction portion of the project life-cycle.

A major literature survey in the UK[6] on project success and failure including the analysis of eight case studies led to 80 factors that are important to project success. The factors were grouped under the following ten headings:

- project definition
- planning and design
- politics
- schedule duration
- schedule urgency
- finance
- legal agreements
- contracting
- project management
- human factors

Whilst the above authors have concentrated on identifying the factors of success, others investigated the causes of project failure[7] and the common reasons of project management failure[8].

The identification of the success factors and the causes of failure is very useful in that it provides project owners, contractors and other stakeholders with the lessons learned from past projects. Whether success, however, can be replicated is questionable in view of the different context in which projects are executed each time. Nevertheless, it ought to be possible to prevent repeating mistakes whilst paying attention to the factors which have proved to lead to success on other projects.

Project success factors are also very useful for analysing why projects are a success or a failure but cannot be used for measuring the degree of success.

PROJECT OBJECTIVES

The criteria for project success are generally considered to be cost, time and quality/performance in the project literature. It is also generally recognized that there will have to be trade-offs between the three criteria. This simplistic approach originates from the conventional view that the objectives of a project are to complete it on time, within budget and to quality/performance specification. This approach is too simplistic, as determining the project objectives is somewhat more complicated than that. This can be demonstrated in the discussion below on the way objectives vary by type of project, throughout the project life cycle, the level considered in the management hierarchy and the stakeholders involved.

Project classification

One way of classifying projects is by[2]:

- public-sector projects, i.e. space, defence, education and research projects,
- commercial projects, i.e. all private-sector projects and some Government projects.

The objectives of public-sector projects tend to be political, military or social, whilst commercial projects have primarily economic objectives.

A more comprehensive project classification by project motive is shown below[9]:

Motive	Project	Overriding objective	Primary discipline
Necessity	Thames	It should work	Engineering
Opportunity	Nuclear power plant, oil field development	It should pay	Economics
Prestige	Eiffel tower, Sydney Opera House	It should exist	Politics
Research	CERN project	Reaching a solution	Science

Of course, major projects have a mixture of motives, objectives and disciplines involved. However, it is essential to decide which is the dominant factor.

Certain combinations are simply not possible such as a prestigous and at the same time economic office building. The Hong Kong and Shanghai Banking Corporation found that out at their expense[10]. At a construction cost of £465M and £690M, if professional fees and financing costs are included, they can now rightly claim to occupy the world's most expensive office building. The value of the building based on the current rate per square foot of Hong Kong's most prestigous office space is less than £200M. 'We have a building that cost much more than we reckoned it would', said the Chairman, 'but we do have a fabulous building'. It shows that if one is faced with a project failure, it is always possible to come up with some arguments why it is a success. In the Bank's 1985 Annual Report, under operational highlights, it reports that the new headquarters is already bringing benefits in the form of low running costs and efficiency of operations. Certainly, the real test of success is whether the Bank would have initiated the project had they known the real costs of it.

Without a clear understanding of to which category a project primarily belongs and the identification of the ranking of objectives, there can be no basis for the determination of success.

Project life-cycle phases

The emphasis on what is important in a project, changes from one phase of the project to the next. In addition, the cost, time and quality trade-off varies for each phase of the project.

> 'During the early phase of the project, schedule is of primary importance, while cost takes second place and quality third. Later in the project, cost becomes the controlling interest, with schedule taking a secondary role. After the project has been completed, schedule and cost problems are easily forgotten and quality becomes the key'[11].

The terminology used to describe the phases of the project life-cycle vary between type of project and industry. Project management books usually omit the

operational phase because they tend to be written from a consultant's or contractor's perspective.

Nevertheless, a good operational performance is vital for all projects. The experience during this phase will have a dramatic impact on the perceived or real success of a project. The disaster with the space shuttle 'Challenger' in January 1986 is perhaps an appropriate example. Conversely, Concorde is enjoying an increasing degree of success during the operational phase.

To demonstrate how the primary objectives vary throughout the total project life-cycle, the main phases of an oil-field development project are shown below:

Phases	Primary objective
Exploration	Find oil in large enough quantity for development
Development	Develop the oil field in the most economic manner
Production	Maximize daily production and optimize total oil recovery.

The difference in the primary objectives in each project phase results also in other success criteria.

The overriding objective is of course economic. But one may not know until the field is virtually depleted whether or not it has been a success. In the meantime, the primary objectives tend to be used to determine the performance and success of each phase. The perception of success or failure is also time dependent. The project may appear to be a disaster or a success now, though later these perceptions may change. Some North Sea oil projects have gone from disaster to success and back to disaster, following the latest slump in oil prices. In the 1970s, the exploration activity in the North Sea was very successful. The development phase of most projects suffered from budget and schedule overruns but the projects were saved from disaster by the substantial increases in the price of oil in 1973 and 1979. The production phase has also not lived up to expectation as on average the production rates have been lower and reserve estimates reduced, but again this was compensated by the price increases. The slump in oil prices in 1986 has, at least temporarily, changed success into failure.

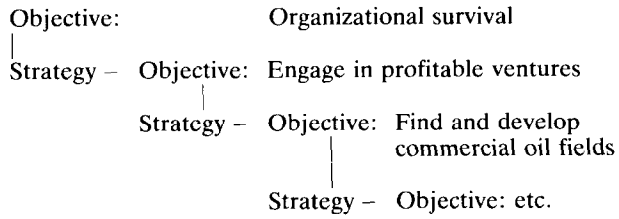
This example demonstrates that although the primary objectives for each project phase may vary, profitability remains the overriding objective on commercial projects throughout the project life cycle.

The hierarchy of project objectives

The concept of a hierarchy of objectives is useful for the understanding of the relationship between organization objectives and project objectives. Each objective is linked to the others in a means-end chain[12].

In this process, every objective or end requires a decision about the means or strategy by which it will be attained. In such a chain, the strategy for accomplishing the next higher-level objectives becomes the objective of the level below.

Returning to the oil company example, whose three highest levels of objectives may be presented as follows:



Thus the project objectives are subordinate to higher-level organization objectives.

In a commercial project, the lower-level objectives of the project execution phase (e.g. cost, time and quality) are subordinate to the objective at a higher level (e.g. profitability).

This explains why projects which ought to be considered a disaster in project management terms, are perceived as successes, simply because the higher-level objective was met.

An interesting example of the importance of higher-level objectives is perhaps the British 'Nimrod' airborne early warning project. The Government ordered eleven aircraft in 1977 at a total cost of £300M for delivery commencing in 1981. After nine years of work and a commitment of £1 000M, the project was running at least four years late[13]. Although the project received a lot of adverse publicity on cost and schedule, the biggest problem was that they had difficulties in achieving the highest level objective of getting it to work. It was for that reason that the Government decided to abandon the project in favour of Boeing's 'AWACs'.

Project stakeholders

The two most obvious parties having a stake in any project are the client and the contractor. But what is often overlooked is that there are however, other stakeholders that have a key interest in the outcome of the project as well[14]. Projects must take into consideration outside parties whose actions can change the course of the project or even destroy it[15]. The objectives of the stakeholders involved in a project are unlikely to be congruent. The most obvious example is that of the objectives of the client and the contractor. The aim of the client is to minimize the cost of the project and that of the contractor to maximize profit.

Lichtenberg[16] identified some six groups of stakeholders on the University Hospital Project, each with their own objectives. They ranged from the Government, who wanted a fairly limited investment, to local politicians and other key people who wanted to build an impressive monument. Project managers should be aware of all the stakeholders and their objectives. They will find it difficult to please all of them because of the often conflicting objectives. Political skill will be a useful attribute on the part of the project manager to assure maximum satisfaction among the stakeholders. This is of special importance on public-sector projects. An evaluation of the success of the Polaris Ballistic Missile Programme showed, for example, that 'success requires skills in bureaucratic politics'[17].

Environmmental groups are perhaps a good example of stakeholders one must reckon with. For example, the decision whether to build the Sizewell 'B' nuclear power station in Britain was held up for more than

three years by one of the most complex public inquiries ever mounted in Britain[18].

THE PROJECT SUCCESS FRAMEWORK

With so many objectives on any one project, it becomes difficult to see the wood for the trees. However, the relationship and the interdependencies of the objectives can be clarified by the use of a 'project success framework' (see Figure 1). This framework is drawn up for a commercial oil-field development project, from the client's perspective. But the basic framework can also be used to illustrate the relationship between objectives from the contractor's perspective or, say, noncommercial public-sector projects.

The framework is largely self-explanatory. The triangle represents the client's organization with the three levels of management. The base of the triangle depicts the project life-cycle. The circle separates the client's organization and the project from the environment or outside world, with the external stakeholders. It also shows how the objectives vary from phase to phase in the project life-cycle including the hierarchical relationship.

The distinction between project objectives and company objectives fades at the higher management levels.

Measuring success involves an evaluation of the degree to which the objectives have been achieved. In this process, the objectives become the success criteria. But with so many success criteria, of which some are conflicting with each other, it appears unlikely that any project can be a complete success for all stakeholders during the entire life of the project.

Therefore, referring to a project as being a success or a failure without qualification is a nonsense.

MEASURING SUCCESS

The success of a project and project management may be determined by evaluating peformance against success criteria[4] or objectives[19]. However, the identification of success criteria or objectives to be measured presents a problem, as discussed above.

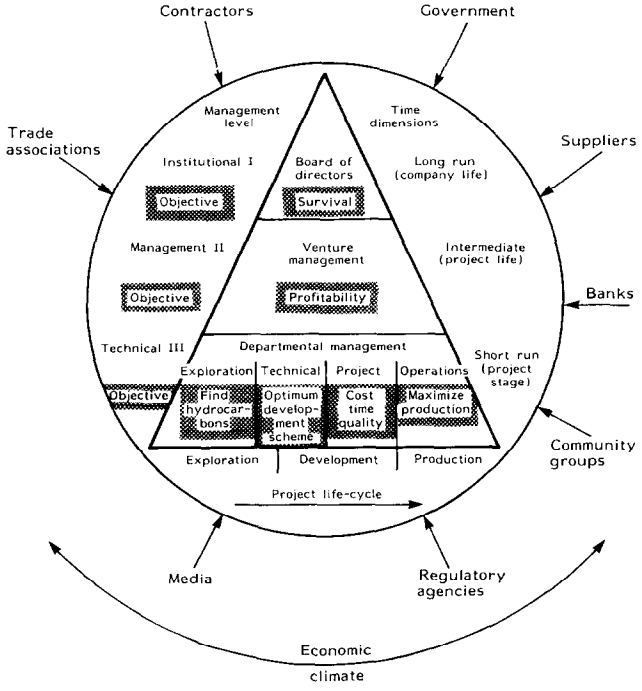


Figure 1. Project success framework

The measurement of performance forms the basis for determining success. But how does one specify the required level of performance for success? How much cost and time overrun is acceptable for a successful project? Certainly, the lack of acceptable performance-variation criteria hampers the measurement of success of a single project. In research, this problem is usually overcome by the measurement of comparative performance of a number of projects.

Three methods of measuring success from the project-management literature will be discussed.

The first method by Might and Fisher[20] was used to examine the role structural factors play in influencing the success or failure of project management. To achieve this, the following measures of success were employed:

- Overall: the subjective measure of the overall success as perceived by the respondant.
- Cost: the measure of the cost over/underrun as a percentage of the initial estimate.
- Schedule: the measure of the schedule over/underrun as a percentage of the initial estimate.
- Tech 1: the subjective assessment of the technical success relative to the initial plan.
- Tech 2: the subjective assessment of the technical success relative to other development projects in the firm.
- Tech 3: the subjective assessment of the technical success measured in terms of the technical problem identification process.

This research was based on a mail survey of 103 development projects in 30 different firms. As it was recognized that project success is dependent upon the type of project involved, the survey was limited to development projects. Approximately 75% were sponsored by the Department of Defense and NASA.

It is interesting to note that the researchers only considered cost and schedule to be measurable and that the other success measures were considered to be only subjective assessments.

The relative weighting of the success criteria by the respondants of the survey was:

Success criteria	Relative weight (%)
Technical performance	54
Cost performance	23
Schedule performance	22

The importance given to technical performance is as expected for development-type Government contracts.

The study concluded *inter alia* that 'the choice and articulation of specific performance criteria should be given considerable care. Since the traditional criteria, cost, schedule and technical performance are not unambiguously related, it is conceivable that the project manager may be managing with one set of expectations while his/her performance is being judged on the basis of another'.

The extent of the measurement of success appears to

be limited to the project development phase with only the contractors as stakeholders.

This method, in common with others, uses only effectiveness criteria to measure project-management performance. However, a measurement without efficiency consideration cannot be complete[21]. Everyone would agree that if Team A carries out an identical project to that of Team B but with less staff, and both were completed on time and within budget, then Team A's performance is better than Team B's.

The second method[6,22] is based on the use of three measures for project success:

- project functionality
  - financially
  - technically
  - or otherwise
- project management
  - budget
  - schedule
  - technical specification
- contractors' commercial performances
  - short term
  - long term

Using the case study approach, this method was recently applied on eight major projects (primarily British) to determine the pre-conditions of success and failure.

The measures of success covered the objectives of virtually all stakeholders shown in the 'project success framework', including all management levels and the total project life-cycle where possible. By doing so, it became extremely difficult to give an unequivocal verdict of success or failure as some criteria were successful whilst others were failures. Any weighting of the success criteria would only provide an artificial answer.

The third method was for the evaluation of the Polaris project[17]. It takes the view that success on Government programmes can be defined in terms of satisfaction by those affected. Absence of criticism is then taken as a mark of success. The Polaris programme has been virtually without critics and praise was found in abundance. Such a situation requires that the project goals are viewed as being in the interest of nearly everyone, or at least not against the interest of many. The factors supporting such a situation are:

- favourable environment
- winning skill in bureaucratic politics through four strategies:
  - differentiation
  - co-optation
  - moderation
  - managerial innovation
- an ability to manage technological development.

In turn these factors may be used to assess the performance of major public-sector projects where politics dominate and perceived success is more important than real success.

In summary, the first method is primarily concerned with the measurement of project-management success, the second and third method cover both project and project management. The latter, however, took success as given and sought to identify, as the author puts it, 'the secrets of success'.

The measurement of success seems invariably to concern itself with either completed projects or at least a completed project phase. In such a case, the measurement of success does not contribute to the control of a project.

Project-performance measurement itself is an essential part of project control. Any attempt to link performance to success is unlikely to be productive for project-control purposes, because of the large number of variables involved.

CONCLUSIONS

It is evident that measuring success is complex and a project is hardly ever a disaster or failure for all stakeholders during all phases in the project life-cycle. Therefore, a project can be a success for one party and a disaster for another. Success is also time dependent. A project may be perceived a success one day and a failure the next. Therefore, to think that one can objectively measure the success of a project is an illusion.

Nevertheless, the study of completed projects or performing an intermediate or post-completion audit is a valuable exercise; not so much to determine in absolute terms the success or failure but to identify what went right and what went wrong and why, in order to apply the lessons learnt on subsequent projects if appropriate.

REFERENCES

1 **Baker, B N, Murphy, D C and Fisher, D** 'Factors affecting project success', in **Clelland and King (Eds)** *Project management handbook* Van Nostrand Reinhold, USA (1983)

2 **Sykes, A** 'Reducing neglected risks on giant projects', in **Kelly A J (Ed.)** *New dimensions of project management* Lexington Books, DC Heath and Company, USA (1982)

3 **Hayfield, F** 'Basic factors for a successful project' *Proc. 6th Internet Congress* Garmisch-Partenkirchen FRG (1979) pp 7–37

4 **Ashley, D B** 'New trends in risk management' Internet's 10th Int. Expert Seminar on 'New Approaches in Project Management', Zurich (March 10–12, 1986)

5 **Ashley, D B, Lurie, C S and Jaselskis, E J** 'Determination of construction project success' *Proj. Manage. J.* Vol XVIII No 2 (June 1987)

6 **Morris, P W G and Hough, G H** 'The pre-conditions of success and failure in major projects' Technical Paper No 3, Major Projects Association, Templeton College, Oxford (1986)

7 **Asquith, J P** 'Potential barriers to success in project management' *Process Econom. Int.* Vol 1 No 2 (Winter 1979/80)

8 **Avots, I** 'Why does project management fail?' *California Manag. Rev.* Vol 12 No 1 (1969)

9 **Fraser, D** 'An approach to major projects', Major Projects Association, Oxford (1984) pp. 11–12
10 **Amery, C and Dodwell, D** 'Monument to money' *The Financial Times* (5th April, 1986)
11 **Avots, I** 'Information systems for matrix organisations' in **Cleveland David I (Ed.)**, *Matrix management systems handbook* Van Nostrand Reinhold, New York (1984) pp 535–537
12 **Jackson, J H and Morgan, C P** *Organisation theory – a macro perspective for management*, Prentice-Hall, Englewood Cliffs, New Jersey (1978) pp 106–107
13 **Cowton, R** 'Will Younger strike down the mighty hunter?' *The Times* (24th January, 1986)
14 **Cleveland, D I** 'A strategy for ongoing project evaluation' *Proj. Manage. J.* Vol 16 No 3 (August 1985) pp 13–14
15 **Avots, I** 'Information systems for matrix organisations' in **Cleveland David I (Ed.)**, *Matrix management handbook* Van Nostrand Reinhold, New York (1984) pp 550–552
16 **Lichtenberg, S** 'Project objectives and budgets: how to link them' *Proc. 8th Int. Expert Seminar*, Zurich (September 19–20, 1983) pp 63–68
17 **Sapolsky, H M** *The Polaris system development* Harvard University Press, Cambridge, MA (1972) p 246
18 **Fishlock, D and Wilkinson, M** 'Britain's nuclear industry – the make or break year' *The Financial Times* (25th February, 1986)
19 **Youker, R and Burnett, N R** 'Defining the hierarchy or project objectives' *Proc. 8th Int. Expert Seminar on Project Management by Objectives* Zurich, Switzerland (September 19–21, 1983)
20 **Might, R J and Fisher, W A** 'The role of structural factors in determining project management success' *IEEE Trans. Eng. Manage.* Vol EM 32 No 2 (May 1985) pp 71–77
21 **De Wit, A** 'Cost effective owner project management – the challenge for the future' *Proc. 8th World Congress on Project Management* Rotterdam (May 19–24, 1985) pp 444–452
22 **Morris, P W G and Hough, G H** *The anatomy of major projects* John Wiley & Sons, UK (1987)

Anton de Wit studied mechanical engineering in Holland and obtained a diploma in acccounting and finance (C. Dip. A.F) and a master of business administration degree (MBA) in the UK. He has 18 years of experience an oil and gas development projects and has held the positions of project coordinator, construction manager and project manager. During this period he worked for contractors, engineering consultants and oil companies on projects throughout Europe, the USA, Nigeria and Egypt. Since 1987 he has been engineering manager with Deminex (Norge) A/S following a 5 year period with Deminex UK Oil and Gas Ltd in London, UK.